CLAIMS

1. A baffle structure for preferentially contouring the flow path of a process fluid flowing cross-wise across and contacting a plurality of spaced-apart heat transfer surfaces, said structure comprising at least a paired set of fluid flow constrictors defining a substantially cross-wise flow path associated with a heat transfer surface, said fluid flow constrictors being located respectively in at least partial upstream and downstream alignment with each other and with the associated heat transfer surface, or along opposite sides of the associated heat transfer surface, or both, so as to contour the flow path of said process fluid around the heat transfer surface to realize improved thermal contact with the surface.

2. A baffle structure according to claim 1 wherein the fluid flow constrictors associated with a heat transfer surface comprise multiple pairs of fluid flow constriction apertures in baffles spaced respectively upstream and downstream from a heat transfer surface.

3. A baffle structure according to claim 2 wherein said heat transfer surfaces comprise the exterior surfaces of an array of heat exchange conduits oriented to have parallel axes, and the multiple pairs of apertures associated with a heat exchange conduit are aligned in columns parallel to the axis of the associated conduit.

4. A baffle structure according to claim 2 wherein said heat transfer surfaces comprise the exterior surfaces of at least one generally circular array of heat exchange

conduits oriented to have parallel axes, and said baffles spaced upstream and downstream from the heat exchange conduits comprise concentric apertured cylindrical plates having axially disposed columns of apertures, each array of heat exchange conduits being disposed in the annular region between two of said apertured cylindrical plates.

5. A baffle structure according to claim 4 wherein each pair of fluid flow constriction apertures comprise holes in radial alignment with the axis of said concentric cylindrical plates.

6. A baffle structure according to claim 4 wherein each pair of fluid flow constriction apertures comprise elongated slots, each slot having a long axis generally parallel to the axis of the associated heat exchange conduit.

7. A baffle structure according to claim 6 wherein pairs of elongated slots are in radial alignment.

8. A baffle structure according to claim 6 wherein a heat exchange conduit is associated with two pairs of elongated slots, each slot pair being offset from radial alignment with the axis of said concentric cylindrical plates.

9. A baffle structure according to claim 8 wherein the two upstream and two downstream elongated slots associated with a heat exchange conduit are axially offset from one another.

10. A baffle structure according to claim 1 wherein said heat transfer surfaces comprise the exterior surfaces of at least one generally circular array of heat exchange conduits oriented to have parallel axes, at least some of which are at least partially surrounded by substantially concentric apertured sleeves having upstream and downstream aperture pairs in columns parallel to the axis of the associated conduit, further wherein each concentric shell is secured by a plate member to adjacent concentric shells in the circular array to form a larger cylindrical structure.

11. A baffle structure according to claim 10 wherein the aperture pairs comprise elongated slots, each slot having a long axis generally parallel to the axis of the associated heat exchange conduit.

12. A baffle structure according to claim 11 wherein pairs of elongated slots are in radial alignment.

13. A baffle structure according to claim 11 wherein a heat exchange conduit is associated with two pairs of elongated slots, each slot pair being offset from radial alignment with the axis of the larger cylindrical structure.

14. A baffle structure according to claim 13 wherein the two upstream and two downstream elongated slots associated with a heat exchange conduit are axially offset from one another.

15. A baffle structure according to claim 10 wherein said heat transfer surfaces comprise the exterior surfaces of at least two generally concentric arrays of heat exchange conduits.

16. A baffle structure according to claim 15 wherein the aperture pairs comprise elongated slots in radial alignment, each slot having a long axis generally parallel to the axis of the associated heat exchange conduit.

17. A baffle structure according to claim 2 wherein said heat transfer surfaces comprise the exterior surfaces of a substantially rectangular array comprising at least two aligned rows of heat exchange conduits oriented to have parallel axes, and wherein said baffles comprise apertured plate members located upstream of the first row of heat exchange conduits, downstream of the last row of heat exchange conduits, and between each row of heat exchange conduits.

18. A baffle structure according to claim 17 wherein said fluid flow constriction apertures comprise columns of apertures in said plate members, said columns of apertures being aligned with the respective axes of the associated heat exchange conduits.

19. A baffle structure according to claim 2 wherein said heat transfer surfaces comprise the exterior surfaces of a substantially rectangular array comprising at least three aligned rows of cylindrical heat exchange conduits oriented to have parallel axes, and wherein said baffles comprise either: (a) apertured plate members located upstream of the first row of heat exchange conduits, downstream of the last row of heat exchange

conduits, and between each row of heat exchange conduits; or (b) apertured sleeve members having upstream and downstream aperture pairs.

20. A baffle structure according to claim 2 wherein said heat transfer surfaces comprise the exterior surfaces of a substantially rectangular array comprising at least three rows of cylindrical heat exchange conduits, with alternate rows offset from adjacent upstream and downstream rows, the heat exchange conduits oriented to have parallel axes, and wherein said baffles comprise either: (a) apertured plate members located upstream of the first row of heat exchange conduits, downstream of the last row of heat exchange conduits, and between each row of heat exchange conduits; or (b) apertured sleeves having upstream and downstream aperture pairs.

21. A baffle structure according to claim 1 wherein the fluid flow constrictors associated with a heat transfer surface comprise substantially flat plate members positioned in pairs edgewise alongside two sides of a heat transfer surface in proximity to the surface, said plate members being oriented generally orthogonal to said flow path.

22. A baffle structure according to claim 1 wherein the fluid flow constrictors associated with a heat transfer surface comprise plate members positioned in pairs alongside two respective sides of the heat transfer surface in proximity to the surface, said plate members having a contour corresponding to the two respective sides of the heat transfer surface so as to create channels having upstream and downstream openings along the two sides of the heat transfer surface, said plate members being joined to other plate members associated with adjacent heat transfer surfaces.

23. A baffle structure according to claim 1 further wherein a heat transfer surface comprises heat-transfer enhancing structures.

24. A baffle structure according to claim 23 wherein said heat-transfer enhancing structures comprise fin elements.

25. A method for enhancing heat transfer to or from a fluid flowing cross-wise in contact with the outer surfaces of a plurality of axially-oriented heat exchange conduits comprising the step of preferentially contouring fluid flow across the outer surfaces by flowing the fluid in a direction generally orthogonal to the axis of a heat exchange conduit, through at least a paired set of fluid flow constrictors associated with said heat exchange conduit in at least partial upstream and downstream alignment with each other and with the associated heat exchange conduit, or along two sides of the associated heat exchange conduit, or both.

26. A method according to claim 25 wherein said fluid is flowed through at least an aperture in a baffle upstream of a heat exchange conduit, contacted with the associated heat exchange conduit, and thereafter flowed through at least an aperture in a baffle downstream of the heat exchange conduit.

27. A method according to claim 26 wherein the apertures in the baffles comprise elongated slots.

28. A method according to claim 26 wherein said fluid is flowed through two apertures, each offset from the direction of fluid flow, in a baffle upstream of a heat exchange conduit, contacted with the associated heat exchange conduit, and thereafter flowed through two apertures, each offset from the direction of fluid flow, in a baffle downstream of the heat exchange conduit.

29. A method according to claim 25 wherein said fluid is flowed through an array comprising at least one upstream and one downstream row of heat exchange conduits in which a heat exchange conduit is associated with at least a paired set of fluid flow constrictors.

30. A method according to claim 29 comprising three or more rows of heat exchange conduits wherein said fluid flow constrictors comprise either: (a) apertured plate members located upstream of the first row of heat exchange conduits, downstream of the last row of heat exchange conduits, and between each row of heat exchange conduits; or (b) apertured sleeves having upstream and downstream aperture pairs.

31. A method according to claim 30 wherein said rows of heat exchange conduits are aligned to create substantially linear channels through the array.

32. A method according to claim 31 wherein the fluid is flowed through the array in a direction orthogonal to the rows of heat exchange conduits.

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33. A method according to claim 31 wherein the fluid is flowed through the array in a direction diagonal to the planes of the rows of heat exchange conduits.

34. A method according to claim 30 wherein alternate rows of heat exchange conduits are offset relative to one another.

35. A method according to claim 34 wherein fluid is flowed through the array in a direction orthogonal to the planes of the rows of heat exchange conduits.

36. A method according to claim 34 wherein fluid is flowed through the array in a direction diagonal to the planes of the rows of heat exchange conduits.

37. A method according to claim 25 wherein said fluid is flowed through channels along two respective sides of a heat exchange conduit, said channels being defined by at least a pair of substantially flat plate members positioned edgewise alongside the two respective sides of the heat exchange conduit, in proximity to the outer surface of the heat exchange conduit, the plate members being oriented generally orthogonal to the direction of fluid flow.

38. A method according to claim 25 wherein said fluid is flowed through channels along two respective sides of a heat exchange conduit, said channels being defined by a pair of plate members positioned alongside the two respective sides of the heat exchange conduit in proximity to the outer surface of the conduit, said plate members having a

contour corresponding to the two respective sides of the heat exchange conduit and being joined to other plate members associated with adjacent heat exchange conduits.

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